Text Solutions—pg. 238—243, #3, 4, 5, and 9
Pg. 253, #40 (Non-scannable)

3. Gas mileage.

a) The association between weight and gas mileage of cars is fairly linear, strong, and negative. Heavier cars tend to have lower gas mileage.

b) For each additional thousand pounds of weight, the linear model predicts a decrease of 7.652 miles per gallon in gas mileage.

c) The linear model is not appropriate. There is a curved pattern in the residuals plot. The model tends to underestimate gas mileage for cars with relatively low and high gas mileages, and overestimates the gas mileage of cars with average gas mileage.

4. Crowdedness.

a) The scatterplot shows that the relationship between Crowdedness and GDP is strong, negative, and curved. Re-expression may yield an association that is more linear.

b) Start with logs, since GDP is non-negative. A plot of the log of GDP against Crowdedness score may be straighter.

5. Gas mileage revisited.

a) The residuals plot for the re-expressed relationship is much more scattered. This is an indication of an appropriate model.

b) The linear model that predicts the number of gallons per 100 miles in gas mileage from the weight of a car is: $\widehat{Gal}/100 = 0.625 + 1.178(Weight)$.

c) For each additional 1000 pounds of weight, the model predicts that the car will require an additional 1.178 gallons to drive 100 miles.

d)

$\widehat{Gal}/100 = 0.625 + 1.178(Weight)$
$\widehat{Gal}/100 = 0.625 + 1.178(3.5)$
$\widehat{Gal}/100 = 4.748$

According to the model, a car that weighs 3500 pounds (3.5 thousand pounds) is expected to require approximately 4.748 gallons to drive 100 miles, or 0.04748 gallons per mile.

This is $\frac{1}{0.04748} \approx 21.06$ miles per gallon.

Text Solutions—pg. 238—243, #3, 4, 5, and 9
Pg. 253, #40 (Non-scannable)

d)

$$\sqrt{\widehat{Distance}} = 3.303 + 0.235(Speed)$$
$$\sqrt{\widehat{Distance}} = 3.303 + 0.235(55)$$
$$\sqrt{\widehat{Distance}} = 16.228$$
$$\widehat{Distance} = 16.228^2 \approx 263.4$$

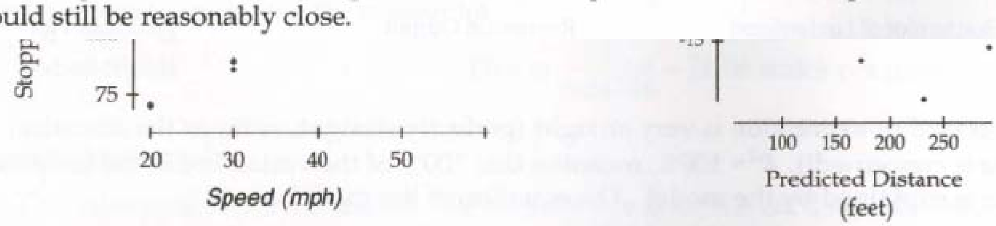
According to the model, a car traveling 55 mph is expected to require approximately 263.4 feet to come to a stop.

e)

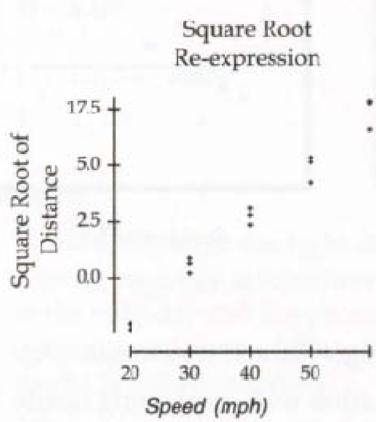
$$\sqrt{\widehat{Distance}} = 3.303 + 0.235(Speed)$$
$$\sqrt{\widehat{Distance}} = 3.303 + 0.235(70)$$
$$\sqrt{\widehat{Distance}} = 19.753$$
$$\widehat{Distance} = 19.753^2 \approx 390.2$$

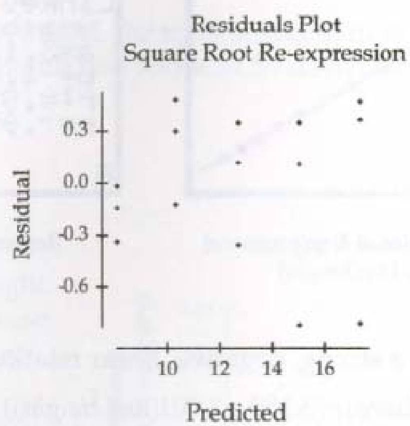
According to the model, a car traveling 70 mph is expected to require approximately 390.2 feet to come to a stop.

f) The level of confidence in the predictions should be quite high. R^2 is high, and the residuals plot is scattered. The prediction for 70 mph is a bit of an extrapolation, but should still be reasonably close.



b) Stopping distances appear to be relatively higher for higher speeds. This increase in the rate of change might be able to be straightened by taking the square root of the response variable, stopping distance. The scatterplot of Speed versus $\sqrt{Distance}$ seems like it might be a bit straighter.





c) The model for the re-expressed data is $\sqrt{\widehat{\text{Distance}}} = 3.303 + 0.235(Speed)$. The residuals plot shows no pattern, and R^2= 98.4%, so 98.4% of the variability in the square root of the stopping distance can be explained by the model.